

Claims

1 1. A golf club shaft formed by winding a plurality of layers around a
2 mandrel that is removed after curing comprising:

3 a layer of metal-containing prepreg wrapped at a tip of the shaft;

4 and

5 a layer of non-metal fiber prepreg wrapped adjacent to the layer of

6 metal-containing prepreg throughout a length of the shaft.

1 2. The golf club shaft of Claim 1 wherein the layer of

2 metal-containing prepreg wrapped at the tip of the shaft comprises a first layer of

3 metal-containing prepreg and a second layer of metal-containing prepreg

4 3. The golf club shaft of Claim 1 wherein the golf club shaft has a

5 mass of about 80 - 130 g.

6 4. The golf club shaft of Claim 1 wherein the golf club shaft has a

7 center of mass located at about 45~51% when measured from the tip and

8 expressed as a ratio to an overall length of the golf club shaft.

9 5. The golf club shaft of Claim 1 wherein the gold club shaft has an

10 elasticity index (EI) value about $3.0 \sim 4.5 \text{ kgf} \cdot \text{m}^2$ at 200 mm from the tip.

11 6. The golf club shaft of Claim 1 wherein the layer of

12 metal-containing prepreg located at the tip of the shaft is an inner-most layer.

13 7. The golf club shaft of Claim 6 wherein the inner-most layer of
14 metal-containing prepreg is located along a length of the shaft between a tip of
15 the shaft and 40% of an overall length of the shaft.

16 8. The golf club shaft of Claim 6 wherein the layer of non-metal
17 fiber prepreg is wrapper over the inner-most layer of metal-containing prepreg.

18 9. The golf club shaft of Claim 1 wherein the layer of
19 metal-containing prepreg comprises a metal having a specific mass greater than
20 7 g/cm³.

21 10. The golf club shaft of Claim 1 wherein the layer of
22 metal-containing prepreg contains a metal fiber.

23 11. The golf club shaft of Claim 1 wherein the layer of
24 metal-containing prepreg contains a metal powder.

25 12. The golf club shaft of Claim 11 wherein the metal powder is
26 dispersed in a synthetic resin sheet.

27 13. The golf club shaft of Claim 12 wherein the metal powder
28 comprises tungsten.

29 14. The golf club shaft of Claim 12 wherein the synthetic resin
30 sheet comprises epoxy resin.

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31 15. A method of making a golf club shaft comprising the steps of:
32 providing a mandrel that tapers from a butt end to a tip end;
33 wrapping a layer of metal-containing prepreg around the mandrel
34 from the tip end thereof toward and toward but not all the
35 way to the butt end thereof;
36 wrapping a layer of non-metal fiber prepreg adjacent to the layer of
37 metal-containing prepreg from the tip end thereof all the way
38 to the butt end thereof;
39 curing the prepreg; and
40 removing the mandrel from the prepreg.

41 16. The method of making a golf club shaft of Claim 1 wherein the
42 mandrel has a nonlinear taper along its length that creates an annular recess at
43 the tip end thereof and wherein the step of wrapping a layer of metal-containing
44 prepreg around the mandrel from the end thereof toward but not all the way to
45 the butt end thereof is accomplished by wrapping the layer of metal-containing
46 prepreg around the mandrel along the annular recess.

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